Koi Pond Water Parameters: The Reference Table

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REFERENCE

Every number a koi keeper needs, in one place: what each parameter is, the target range, what an off reading actually means, and the column most charts leave out — how fast that value can move. Some drift over a season. One of them can go from comfortable to dangerous between midnight and sunrise.

In short

- pH anywhere from 7.0 to 8.5 is acceptable. Stability matters more than the exact figure.
- KH — labeled *total alkalinity* on most US test kits — should sit at 6–10 dKH (105–180 ppm). Below 5 dKH the pond loses its grip on pH; below 3 dKH the situation is critical.
- Ammonia and nitrite target zero. Nitrate is tolerable and mostly reports how heavy the load is.
- Dissolved oxygen at 8–10 mg/L is comfortable, 7 mg/L is the practical floor, and it is by far the fastest-moving number on the list.

The master table

Values below are for ornamental koi in a filtered, stocked pond. Where a US kit uses a different label than the hobby shorthand, both are given.

PARAMETER	TARGET	WHAT AN OFF READING MEANS	HOW FAST IT CAN MOVE
Temperature	65–75 °F (18–24 °C) active range; koi tolerate roughly 39–85 °F (4–29 °C)	High temperature raises metabolism and lowers the water's oxygen ceiling at the same time. Rapid change is more stressful than the absolute value.	Hours. A shallow pond can move several degrees between dawn and mid-afternoon; a cold front or a large top-up moves it faster.
pH	7.0–8.5, stable	A number outside the band is worth correcting; a number that *swings* is worth investigating first. Wide daily movement points to a thin buffer or a heavy algae load.	Within a single day. Photosynthesis pushes pH up through the afternoon and lets it fall overnight. A crash can arrive in one night once the buffer is gone.
KH / total alkalinity	6–10 dKH (105–180 ppm)	Below 5 dKH the pond can no longer hold pH steady. Below 3 dKH is critical — this is the condition a pH crash comes from.	Weeks under normal conditions, as nitrification consumes it. Hours after heavy rain, a large soft-water top-up, or an acid load.

PARAMETER	TARGET	WHAT AN OFF READING MEANS	HOW FAST IT CAN MOVE
GH / general hardness	Roughly 60–200 ppm as a mineral baseline	A measure of calcium and magnesium — osmotic comfort and bone or scale mineralization. It is **not** the buffer and will not stop a pH crash.	Months. Effectively a property of your source water.
Ammonia (free NH_3)	0 ppm	Any detectable free ammonia is gill damage in progress. Toxicity climbs sharply with both pH and temperature, which is why the same total-ammonia reading is far more serious at pH 8.5 and 82 °F than at pH 7.0 and 60 °F.	Hours. Overfeeding, a cleaned or medicated filter, or a dead fish out of sight will produce a reading by the next morning.
Ammonium (NH_4^+)	Low and stable	The ionized, far less toxic form. Most US hobby kits report the two together as total ammonia nitrogen; the split between them is set by pH and temperature, not by the kit.	Hours, alongside free ammonia.
Nitrite (NO_2^-)	0 ppm	Acutely toxic. It binds hemoglobin and starves the fish of oxygen in water that tests fine for oxygen. Fish gasp at the surface with no obvious cause.	Hours to days. The classic spike is two to five days after a biofilter is disturbed, medicated, or overloaded.
Nitrate (NO_3^-)	Ideally below 40 ppm	Tolerated at levels that would be unacceptable for ammonia or nitrite. Treat it as a load indicator: rising nitrate means feeding, stocking, or water-change volume is out of balance.	Weeks. Slow accumulation between water changes.
Dissolved oxygen	8–10 mg/L comfortable; 7 mg/L the practical floor	Below 6 mg/L is measurable stress. Below 4 mg/L is acutely dangerous. Warm water simply cannot hold as much oxygen, exactly when the fish need more of it.	Minutes to hours. The daily minimum is just before dawn. A warm, heavily stocked pond can fall from comfortable to dangerous in one night.
Salinity	Baseline near zero; therapeutic use typically around 0.3% (3 ppt) for a limited period	Used deliberately as a treatment, not as a permanent condition. Left in place indefinitely it selects for salt-tolerant parasites and complicates every other reading.	Only when you change it. It falls gradually with water changes and rain, which is why treatments quietly drift off dose.
Conductivity / TDS	No single correct figure — know your own baseline	A rising baseline usually means dissolved load is accumulating faster than water changes remove it. Useful mainly as a change signal.	Days to weeks, unless salt or minerals are added.
ORP (redox)	Commonly 250–400 mV in a clean pond; read as a trend	A sustained drop suggests organic load rising faster than the system oxidizes it. The absolute number depends on probe and water chemistry, so compare it against your own history, not someone else's.	Minutes to hours. Responds quickly to organic load, UV, and ozone.

PARAMETER	TARGET	WHAT AN OFF READING MEANS	HOW FAST IT CAN MOVE
Turbidity	Low single-digit NTU in a clear pond; read as a trend	A sudden rise means solids in suspension — a stirred bottom, a failing filter, or an algae bloom collapsing.	Minutes. One of the quickest indicators that something mechanical has changed.
Blue-green algae (phycocyanin) — *optional channel*	No fixed target; read against your own baseline	Phycocyanin is the pigment specific to cyanobacteria, so a rising signal points at a blue-green bloom rather than green algae or stirred-up silt. It is a trend, not a cell count, and it says nothing about toxins.	Days. A blue-green bloom builds over a warm, still spell rather than overnight.

Temperature: the multiplier behind every other number

Temperature is not just one row in the table; it changes the meaning of several others. Warm water holds less dissolved oxygen — a pond that saturates near 11 mg/L at 50 °F may top out closer to 7 mg/L above 80 °F. At the same time, koi metabolism, feeding, and the biofilter's own oxygen demand all rise. Warm water also shifts more of the total ammonia into the toxic free NH_3 form.

So a hot week does three things at once: it lowers the oxygen ceiling, raises oxygen demand, and makes any ammonia present more dangerous. None of those show up on a chart that lists temperature in isolation.

pH, KH and GH: three numbers routinely confused

These are the three most frequently mixed up in koi keeping, so it is worth being blunt about what each one does.

DKH	PPM (TOTAL ALKALINITY)	CONDITION
10+	180+	Strongly buffered. pH will barely move day to day.
6–10	105–180	Optimal. This is the band to aim for.
5	~90	Thin. pH begins to wander with the daily light cycle.
Below 5	Below 90	Unstable. The pond no longer reliably holds pH.
Below 3	Below 54	Critical. A crash is a matter of when, not whether.

pH is the reading; **KH** is what keeps that reading still. Nitrification consumes carbonate continuously, so KH is always being spent — and unlike ammonia, nothing about a low KH looks wrong until the day it fails. Full detail on measuring and restoring it is in the guide to carbonate hardness in ponds.

GH is a different measurement entirely: calcium and magnesium content. It matters for osmoregulation and mineral supply, and it is genuinely stable. But raising GH does not buffer pH. Adding a calcium product to a pond with 3 dKH will not stop the crash, and that misunderstanding costs fish every spring.

Ammonia, nitrite, nitrate: one cycle at three stages

Fish and uneaten food produce ammonia. One group of bacteria converts it to nitrite; a second converts nitrite to nitrate. When the filter is healthy, ammonia and nitrite read zero and nitrate slowly climbs between water changes. When something knocks the filter back — a cleaning that was too thorough, a medication, a cold snap, a power outage — ammonia appears first, then nitrite a few days later.

> A zero ammonia reading at 9 a.m. is not a guarantee for the day. If you have just added fish, fed heavily in warm weather, treated the pond, or cleaned the filter, ammonia can be present by evening. Nitrite typically follows two to five days later. Both are gill-level problems, and by the time behavior changes, exposure has already happened.

Dissolved oxygen: the parameter that moves overnight

MG/L	CONDITION	WHAT YOU WOULD SEE
8–10	Comfortable	Normal feeding, normal activity, fish using the whole pond.
7	Practical floor	Acceptable, with no margin left for a warm night.
Below 6	Stress	Reduced feeding, fish holding near returns and waterfalls.
Below 4	Acutely dangerous	Gasping at the surface, usually at first light.

Oxygen has a daily rhythm that nothing else on this list shares. Plants and algae produce oxygen in daylight and consume it in the dark, alongside the fish and the biofilter. The minimum arrives in the hour before sunrise — which is the one time nobody is standing at the pond with a test kit. A pond that reads 9 mg/L on Saturday afternoon may have passed through 4 mg/L that same morning. The dissolved oxygen guide covers the mechanics and what raises it.

Secondary values: salinity, conductivity, ORP, turbidity

These do not have a single correct value the way ammonia does. Salinity is a deliberate, temporary intervention — worth measuring precisely while a treatment is running, and worth confirming it has come back down afterward. Conductivity and TDS describe accumulated dissolved load. ORP and turbidity are trend instruments: the reading on any given day means little, but a sustained move away from your own established baseline usually precedes something visible in the water.

How often to test, honestly

PARAMETER	ESTABLISHED, STABLE POND	AFTER A TRIGGERING EVENT
Temperature	Daily, or continuously	Continuously through heat waves and cold snaps

PARAMETER	ESTABLISHED, STABLE POND	AFTER A TRIGGERING EVENT
pH	Weekly — ideally once at dawn and once late afternoon	Daily, at both ends of the day
KH / total alkalinity	Weekly to biweekly	Within 24 hours of heavy rain or a large water change
GH	Monthly, or when source water changes	Rarely needed on short notice
Ammonia	Weekly; daily in a new or recently disturbed pond	Daily, sometimes twice daily
Nitrite	Weekly; daily while cycling	Daily for at least a week
Nitrate	Monthly	No urgency
Dissolved oxygen	Whenever water is above about 75 °F, measured before dawn	Overnight, every night, until the weather breaks
Salinity	Only when salt is in use	Daily during treatment

The events that shorten every interval are predictable: adding fish, a jump in feeding, a heat wave, a thunderstorm or heavy rain, any medication or salt treatment, a filter cleaning, an algae treatment, and any power interruption. After any of those, a weekly rhythm is no longer appropriate — the window in which something can go wrong has narrowed from days to hours.

Why periodic spot-checking leaves a gap

Weekly testing produces roughly 52 observations a year out of 8,760 hours. That alone is a small sample, but the sampling *bias* is the larger problem. Tests get run when it is convenient — mid-morning, weekends, in decent weather. That is precisely when pH and dissolved oxygen are at or near their daily maximum. The readings that would have told you something are the ones taken at 5 a.m. after a still, humid night, and almost nobody takes them.

This is why the last column of the table matters more than the target column. If every parameter drifted over weeks, weekly testing would be entirely adequate. It is not adequate for oxygen, and it is not adequate for pH once the buffer is thin.

What H2Koi does, and what it does not. The sonde measures temperature, pH, dissolved oxygen (mg/L and % saturation), conductivity, turbidity, ammonium (NH_4), and nitrate (NO_3) directly. ORP is available as an option, as is a blue-green algae channel reading phycocyanin fluorescence — early warning that a cyanobacterial bloom is developing, not a cell count, and not a toxin measurement. From those it computes KH (0–20 dKH), NH_3, nitrite, salinity, TDS. KH is derived, not a titration, and general hardness (GH) is not reported at all. A self-cleaning wiper keeps the sensors clear between service visits.

It is continuous early warning from industrial-grade sensors. It does not detect disease or parasites. It tells you a number is moving, and when — the rest is still your judgment. We also build bespoke automated water-change systems; we have never found another system that does it, and neither have our clients.

Frequently asked questions

What are the ideal water parameters for a koi pond?

pH 7.0–8.5 and stable; KH (total alkalinity) 6–10 dKH or 105–180 ppm; ammonia and nitrite at zero; nitrate ideally below 40 ppm; dissolved oxygen 8–10 mg/L with 7 mg/L as the floor; temperature 65–75 °F for active koi. The master table above gives the full set alongside what each off reading means.

Is KH the same as total alkalinity?

For pond purposes, yes. US test kits almost always print "total alkalinity" and report in ppm as calcium carbonate; the hobby shorthand KH is reported in dKH. One dKH is about 17.9 ppm, so the 6–10 dKH target is 105–180 ppm on your kit.

Why is my pond pH high in the afternoon and low in the morning?

Photosynthesis. Plants and algae consume carbon dioxide in daylight, which raises pH, then respire at night and let it fall. A modest daily swing is normal. A wide one means the KH is too thin to hold the pond steady — check total alkalinity before adjusting pH itself.

Is 0.25 ppm ammonia safe for koi?

It depends entirely on pH and temperature, which is why free ammonia (NH_3) and ammonium (NH_4^+) are listed separately. The same 0.25 ppm total ammonia is far more toxic at pH 8.5 and 82 °F than at pH 7.0 and 60 °F, because a much larger fraction is present as free ammonia. The safe target for free ammonia is zero in all conditions.

How often should I test my pond water?

In a settled, established pond: pH and ammonia weekly, KH weekly to biweekly, nitrate monthly, oxygen whenever the water is warm. After adding fish, heavy feeding, a heat wave, a storm, a filter cleaning, or any medication, move to daily. The frequency table above sets out both cadences.

What is the difference between KH and GH?

KH is carbonate hardness — the pond's buffer, the thing that stops pH from moving. GH is general hardness, a measure of calcium and magnesium. GH matters for the fish, but it does not buffer anything. If pH is unstable, KH is the number to fix.

How do I know if my koi pond has enough oxygen?

Measure it, ideally just before dawn when levels are at their lowest. Behavior is a late signal: by the time koi are gasping at the surface or crowding the waterfall, oxygen has already been low for hours. Below 6 mg/L is stress and below 4 mg/L is acutely dangerous, and warm water reaches both far more easily than cool water does.
